FORT WADSWORTH, BATTERY RICHMOND
south side of Ayers Road at
Fort Wadsworth, Staten Island
New York City
Richmond County
New York

HAER No. NY-237

HAER
NY
43-ROSE,
2-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Mid-Atlantic Region
Department of the Interior
Philadelphia, Pennsylvania 19106

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NY
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HISTORIC AMERICAN ENGINEERING RECORD
FORT WADSWORTH: BATTERY RICHMOND

HAER NO. NY-237

LOCATION: South side of Ayers Road, Fort Wadsworth, Staten Island, New York City, Richmond County, New York.

UTM: 18.579540.4494400
QUAD: The Narrows, NY-NJ

DATE OF CONSTRUCTION: 1898-99; removed from active service 1932; armament removed 1942.

PRESENT OWNER: United States Department of the Navy Fort Wadsworth, Staten Island, New York, New York.

PRESENT USE: Vacant

SIGNIFICANCE: Battery Richmond is one of twelve batteries constructed at Fort Wadsworth during the reconstruction of U.S. Seacoast Defenses, known as the Endicott program, between 1890 and ca. 1905. It is significant as a representative example of Endicott-era emplacements for 12-inch breech-loading rifles, mounted on disappearing carriages, which were designed and built under the U.S. Army Engineer Department.

PROJECT INFORMATION: Battery Richmond was documented February-June 1988 by Louis Berger & Associates, Inc., of East Orange, New Jersey, for the Department of the Navy, Northern Division, Naval Facilities Engineering Command, Philadelphia. The work was carried out under a Memorandum of Agreement between the Department of the Navy, the New York State Historic Preservation Office and the Advisory Council on Historic Preservation. The project team consisted of John A. Hotopp, Ph.D., Director; Martha H. Bowers, Architectural Historian; Amy Friedlander, Historian; Ingrid Wuebber, Research Historian; Rob Tucher, Photographer; and John R. Bowie, A.I.A., Consulting Architect. See also HAER No. NY-236, Battery Ayers, and HAER No. NY-165, Battery Duane.

I. DESCRIPTION

The subject of this documentation is a seacoast gun battery located at Fort Wadsworth, Staten Island, New York. Fort Wadsworth is a former U.S. Army installation now under the jurisdiction of the U.S. Navy. Fort Wadsworth is situated on the southeast side of Staten Island, at the south end of Bay Avenue. The western anchorage and Interstate-287 approach of the Verazzano-Narrows Bridge are located on the installation, creating a visual, although not physical, boundary between the northern and southern areas of the post.

The steeply-sloping, heavily overgrown shore area on the eastern edge of Fort Wadsworth, overlooking the Narrows, is occupied by a number of fortifications and open platform emplacements constructed at various periods over the installation's history. Inland, the area north of the Verazzano is sparsely developed with military housing and administrative buildings. It is bisected by New York Avenue, at the north end of which is the installation's main gate. South of the bridge, New York Avenue intersects with east-west running Richmond Avenue, on which is a Naval reserve unit, a variety of buildings formerly associated with auto and truck maintenance and repair, and scattered housing. The area south of Richmond Avenue contains 100 units of Capehart military housing and outdoor recreation facilities (swimming pool, picnic grounds, athletic field). Also scattered throughout this area are more former seacoast defensive works, abandoned since at least World War II and now heavily wooded. Just below the New York Avenue-Richmond Avenue intersection are four batteries, extended in a line from northeast to southwest. Battery Richmond is the third in the line, situated between Battery Barry and Battery Ayers. It faces toward New York Bay.

Battery Richmond is one of 12 batteries constructed at Fort Wadsworth between 1895 and 1904, during what is known as the Endicott program of United States coastal defense. It was constructed in 1898-1899 by hire labor working under supervision of the New York District Office of the U.S. Army Engineers, and upon completion was turned over to the Coast Artillery Corps.

Battery Richmond was built for two 12-inch breech-loading rifles mounted on disappearing carriages. The emplacements (numbered from west to east) which compose the battery are functionally self-contained, essentially identical units arranged in linear fashion behind a massive parapet of concrete and earth, covered with sod, in such a manner that they cannot be seen from the front. Each emplacement is arranged with two levels: the upper level carries the gun block, or platform, and the loading platform, while the lower level contains magazines, power supply and storage areas. The magazines and the vertical shell hoist are contained within the traverse to the left (east) of each gun, protected by 10-15 feet of solid concrete. The other spaces on the lower level are arranged around the solid core of the gun block, beneath the loading platform. The principal material of construction is Portland cement concrete, which was poured in vertical formwork the marks of which remain evident today. Steel I-beams support the ceilings of the interior spaces on the lower level.

The point of departure for the plan of the upper level is the gun block, a sunken circular platform, approximately 26 feet in diameter, set about 16 feet below the level of the parapet. At the center of the gun block is a well, 13 feet in diameter, which contained the counterweight which raised the gun to firing position. At both emplacements, the counterweight well has been completely filled in.

From the rear of each gun block, a semicircular flight of steps rises 6 feet to the loading platform, which is approximately 77 feet long and provided access to the gun from any point along the 140-degree traverse (horizontal movement) of whioh it was capable. The height of the loading platform in relation to the gun block is such that a projectile carried on a hand truck could be inserted directly into the breech of the gun in loading position. The outer edge of the loading platform is edged with a low, metal railing.

The principal means of access to the loading platforms is a flight of metal steps at the extreme right end of each platform. At the left side of each gun platform is a set of concrete steps leading down to a now-sealed opening into the lower level. At the extreme southeast corner of each platform, a metal ladder provides access to the crest of the parapet.

Hanging in "oonvenient places" in the masonry of the side and front walls of each platform are wrought iron maneuvering rings fastened to bolts set in shallow niches. These rings appear to have been used to assist in the mounting and dismounting of the gun and carriage. In the wall at the left end of each platform are several rectangular recesses (also called "niches"), one of which contained teleautograph (later telephone) equipment (Hines and Ward 1910:510). The function of other niches is unknown, and they have been completely sealed with concrete.

The left end of each loading platform extends behind the rear wall of the traverse. This wall originally contained the opening through which projectiles hoisted from below were deposited on a delivery "table," and from there moved on hand trucks to the guns. The original location of the shell delivery table is marked by portions of the opening's I-beam lintel. However, the opening has been sealed and almost completely obscured behind a concrete wall. To the right of each delivery table location is a full-height recess, partly extended from and partly cut into the rear wall of the traverse. These recesses were built ca. 1910 to contain delivery tables for electric powder hoists, of which only one, in emplacement No. 1, was installed (RG 77, Miscellaneous Fortifications, Entry 803, Case 14, Sheets 302, 644).

At the extreme rear of the center traverse and each flank traverse is a "crownest," a circular well, approximately 4 feet deep and open at the rear to accommodate a metal ladder, which functioned as an observation post.

The plan of the lower level is the same for each emplacement. The principal entry is situated at the left, between concrete retaining walls flanked by protective earthworks. Beyond the entry is a straight corridor approximately 20 feet long, at the end of which is the shell room or magazine, a windowless rectangular space approximately 11 feet wide and 25 feet deep. A second corridor extends approximately 35 feet to the right (west) just in front of the shell room door. On the inner (south) wall of this corridor is the powder magazine, a large, roughly L-shaped room, 26 feet deep and in its longest dimension, 30 feet. In the outer (north) wall of this corridor, opposite the powder magazine, is a large recess which contained the vertical lift by which shells were hoisted up to the loading platform. The original hoists were Hodges electric and hand-powered front delivery systems. In 1917-1918, these were replaced with hoists manufactured by Taylor-Raymond, to accommodate longer projectiles which had been developed by the Ordnance Department (RG 77, Entry 802, Box 49, File 28, Sheet 18). No machinery nor remains of a hoist frame are now present in either emplacement.

Inside the powder magazine, in the wall to the right of the door, is a "tunnel," approximately 29" in diameter and 20 feet long, which extends upward at an angle of about 35 degrees. This tunnel was drilled in 1910 in order to accommodate a powder hoist, which would raise powder charges from the powder magazine up to a receiving table installed in the recess built beside the shell delivery table on the left side of the loading platform. Although installation of powder hoists was planned for several batteries at Fort Wadsworth, hoists were only installed in one emplacement at Battery Richmond (RG 77, Entry 803, Case 14, Sheets 302, 644). No evidence of hoist equipment remains, and the upper opening of the tunnel is sealed.

These spaces just described are contained within the west flank and center traverses, to the left of emplacements No. 2 and No. 1

respectively. The remaining spaces are arranged beneath each loading platform around the core of the gun block.

The east-west corridor containing the shell hoist terminates, atthe west end, in a short north-south passage. The south end of this passage leads up the stairs leading up to the gun platform. A small trapezoidal room opens off the west side of the passage. Designated on early plans as "storage," this room subsequently contained controls for the electric motors which were used to traverse, elevate and depress each gun (RG 77, Dr. 43, Sheets 96, 96-2). The north end of the passage opens into a large rectilinear space called the shot gallery, which extends over 40 feet across the rear of the emplacement and is 15 feet wide. Although windowless, the shot gallery has two exterior steel doors, outside each of which (but no longer present) was a crane hoist. From the shell room, projectiles could be conveyed, via a traveling hoist or "trolley," suspended from rails, past the vertical lift shot hoist and along the corridors into the shot gallery and to the doors, at which point they would be lifted via the crane hoist to the rear of the loading platform. Beyond the shot gallery (i.e., to the west of it) are two other rooms, both trapezoidal in plan and accessible only from the exterior and through separate entrances. The outer room was originally intended for use as a guard room. The inner room, which is entered from a passage beneath the metal stair to the loading platform, was designated for storage. In 1922, a passage was opened in the wall between these rooms in emplacement No. 1, and two 25 kw water-cooled, gasoline-electric generator sets were installed (RG 77, Dr. 43, Sheet 95-14). In emplacement No. 2, the guard room was converted to a plotting room (with tables and equipment for communication) about 1914, when the battery's electric and communication systems were redone (RG 392, Battery Emplacement Book for Battery Richmond, Section 5(g)).

The rooms and passages of the lower levels of the emplacements all have concrete floors and walls ranging from 2 to 4 feet thick (the latter occurring between the shell room and powder magazine). Flat ceilings, approximately 8 feet high, are carried on I-beams embedded in the concrete. There are no "architectural" features as such, beyond the use of brick in construction of door jambs, and the rounding of corners to prevent chipping.

The lower level spaces of Battery Richmond today evidence numerous alterations pointing to a use rather different from the structure's original purpose. In the west emplacement, both the shell and powder magazines are partitioned into two rooms each, and a large hole for ductwork is opened into the concrete wall between the two magazines. The shot hoist well is partitioned off from the corridor and contains a latrine. The shot gallery is divided into two spaces by a solid concrete block wall. In that part of the gallery still accessible is a small brick bunker for coal and the rusted remains of a coal furnace. Remains of a gas furnace are present in the corridor adjacent to the shot hoist well. The doorway to the steps leading up to the gun platform is sealed with concrete block. In the passage just inside the main entrance is the rusted remains of an air ventilation or purification system, bearing a metal plate which reads: "Chemical Warfare Service U.S.A., Collective Protector Canister MI, Capacity 200 cu. ft. per minute, Edgewood Arsenal, Maryland." Traces of rubber gasket are visible around the edges of the outer door frame.

Alterations are also evident in the eastern emplacement. The powder magazine is subdivided into two spaces, and the shot hoist well contains a latrine. The east end of the corridor adjacent to the shot hoist well contains wooden partitions. A portion of the westernmost room has been completely sealed off, as has the doorway from the lower level to the gun platform.

These alterations appear to have occurred subsequent to the battery's decommissioning, and probably during World War II. The presence of the remains of what appears to be a switchboard in the shell magazine of the west emplacement, coupled with the heating and air purification systems, suggest that Battery Richmond's interior spaces were "remodeled" for use as a secure communications facility. The nature and extent of the alterations are such that the structure clearly could not have served its original function as an emplacement for seacoast rifles after the alterations were made.

Two other structures, only one of which remains, are associated with Battery Richmond. In 1903, a latrine was constructed off the outer wall of the west flank (RG 77, Dr. 46, Sheet 96-3). It had concrete foundations, floor and roof, and exterior walls of brick, and measured approximately 19 feet by 13.5 feet. The interior was divided into two rooms (which were not accessible from one another). One, entered from the east side, contained two toilet stalls, the other, entered from the west side, contained four stalls and two urinals. This structure is no longer present, but traces of its connection with the west flank wall of the battery are still evident.

The second building is situated directly behind the battery, and was built in 1901-1902 as a powerhouse (Secretary of War, Annual Report, 1901, Report of the Chief of Engineers, Part 1, p. 764). It subsequently served as a storage battery room. The brick-walled, one-room building has a concrete floor and corrugated sheet metal roof. Full-height double-leaf doors are present in the south elevation. No equipment or machinery remains.

II. HISTORICAL BACKGROUND

A. Defenses of New York Harbor Prior to the Endicott Program

As Gilmore (1983) notes, "the defense of New York harbor began with the city's founding," in the form of Fort Amsterdam on Manhattan and small blockhouses "at strategic points" around the harbor. Construction of large-scale, permanent works, however, did not occur until after the Revolution, and then initially under the auspices of New York State rather than the fledgling federal government. In 1794, the state purchased a tract on Staten Island including a prominence called Flagstaff Hill, and subsequently erected a blockhouse adjacent to a former British redoubt, which the state also renovated at about the same time. By 1806, however, these works, and those also erected on Ellis and Bedloes Islands, and at the tip of Manhattan, had fallen into disrepair, with only Fort Jay, on Governors Island, in usable condition (Black 1982:30,35,38).

The second period in the history of U.S. coastal and New York Harbor defenses, known as the Second System, was inaugurated in mid-1807 as a result of renewed hostilities between Great Britain and the United States. The federal government embarked upon a new program of construction, with three million dollars authorized between 1807 and 1812 (Black 1982:39). Among works constructed under this program were Fort Columbus (on the site of old Fort Jay), Castle William, new fortifications on Ellis and Bedloes Islands, Castle Clinton and a small battery at the southern tip of Manhattan, and Fort Gates at Sandy Hook (New Jersey). New York State continued to participate in the harbor defense program, however, most notably through new works on the Staten Island side of the Narrows (Black 1982:41).

The Third System of U.S. coastal defense (see Lewis 1970:37ff) initiated shortly after the War of 1812 when a board of inquiry headed by Brig. Gen. Simon Bernard embarked upon a detailed study of existing defenses, reports from which were issued in 1821 and 1826. The board found that "the Harbor of New York in its present state is scarcely at all defended against a sea attack" and to remedy the situation it recommended that the Narrows and Throgs Neck be substantially fortified with works which were classified as of the first priority (Black 1982:64). Under the Third System, construction of major new casemated masonry fortifications was initiated: Fort Schuyler (begun 1833), Fort Totten (1858), Fort Hamilton (1825), Fort Richmond (1847) and Fort Tompkins (1858). These were the last major defensive works to be attempted prior to the Endicott Program.

B. Seacoast Defenses at Fort Wadsworth Prior to the Endicott Program

The Staten Island side of the Narrows was first utilized for military purposes during the Revolutionary War by the British, who in 1778-79 constructed a signal station, earthen redoubt and other fortifications on Flagstaff Hill (Black 1982:22-23). These works, intended to be temporary in nature, were abandoned by the end of the war in 1783. The value of the site, however, was remembered in the 1790s, and as noted above, was included in the defense construction program of New York State. Under the Second System, New York State constructed a water battery (called Fort Richmond), and began a large work on Flagstaff Hill, to be called Fort Tompkins, in 1814. The Staten Island program also included two smaller works, Batteries Hudson and Morton (Black 1982:39-46).

With inauguration of the Third System, the United States, which obtained title to the Staten Island site in 1847, rebuilt Batteries Hudson and Morton. A new water battery replaced New York-built Fort Richmond (known as Battery Weed today), and a new structure was begun on the site of the earlier (and unfinished) Fort Tompkins. Prior to the Civil War, the federal government also initiated several works on heretofore unoccupied sites, including two open barbette batteries on the ridge behind and flanking Fort Richmond (known as North and South Cliff batteries), plus a second casemated water battery which, however, was never completed (Black 1982:80-81).

After the Civil War, Fort Tompkins was completed (although never supplied with armament), before Congress terminated coastal defense appropriations in 1875. Prior to that date, however, the Army managed to remodel North Cliff, South Cliff and Hudson batteries for guns of higher caliber, and to build four new works, including two mortar batteries, a glacis gun battery north of Fort Tompkins, and a two-gun battery south of Fort Tompkins (Black 1982:94,96-97). Fifteen years would pass before construction of the new, Endicott generation of coastal defenses at Fort Wadsworth.

C. The Endicott Program of U.S. Seacoast Defense

The so-called Endicott program for rebuilding U.S. seacoast defenses was formally proposed in 1885 and first funded in 1890. The intent of the program was the complete reconstruction of the nation's coastal defenses (for which Congress had made no appropriations from 1875 to 1890) in order to accommodate, and respond to, revolutionary developments in the design and manufacture of heavy ordnance which occurred in the late nineteenth century. Over the next 15 years, emplacements for some 300 "heavy guns" of 8, 10 and 12-inch caliber were constructed along the nation's coasts, plus emplacements for a variety of smaller caliber weapons and nearly 400 12-inch mortars (Lewis 1970:79).

The short work which rifled naval guns made of the massive stone casemates of Fort Pulaski in the early days of the Civil War effectively rendered existing coastal defenses obsolete (Hogg 1981:173-4). After the Civil War, the use of steel for guns, the perfection of breech-loading and development of more effective propellants produced major changes not only in armament but in the structures in which the armament was mounted. Steel guns, manufactured by new processes involving the "successive shrinking on of many concentric tube members," were lighter, longer and more powerful then their single cast iron predecessors. With the ability to produce longer gun tubes came the ability to utilize new, relatively slow-burning propellants which increased muzzle velocities. With the perfection of breech-loading, the full benefits of rifling, including the use of more effective projectiles, could be realized in the form of greater impact energies, longer ranges, and significantly improved accuracy (Lewis 1970:67,75-76). Breech-loading also enabled guns to be mounted on new kinds of carriages which could be lowered, through the harnessing of their recoil energy, to positions below parapets where they could be more safely loaded, as gun crews no longer were required to work within the enemy's view. The results of these developments were profound: "Compared to the best of the smooth-bore muzzle-loading cannon of the post-Civil War period, the new weapons which began to emerge from the developmental stage around 1890 could fire projectiles that, caliber for caliber, were four times as heavy to effective ranges two to three times as great; and they could do so with remarkably increased armor-penetration ability and accuracy" (Lewis 1970:76).

In 1885, President Grover Cleveland convened a special board headed by Secretary of War William C. Endicott to review the status of the nation's coastal defenses and propose a program for a new generation of defenses based upon the new weapons emerging out of the technological developments previously described. The Endicott Board report, issued in 1886, called for a massive new construction program at 26 points along the coasts and three on the Great Lakes (Lewis 1970:77-78; Annual Report of the Secretary of War, 1886, Report of the Chief of Engineers,

Appendix 3:499ff). Although the original scope envisioned by the Board was not, in the end, fully realized, its recommendations formed the framework within which a "new and completely modern generation of seacoast defenses" (Lewis 1970:78) was developed between 1890 and about 1905.

In the latter year, President Theodore Roosevelt convened a second board, under Secretary of War William Howard Taft, to review the Endicott program and, as necessary, bring it up to date. Recommendations of the Taft board included extending the fortification program to recently acquired territories in the Pacific, and in particular implementation of programs for installation of powerful searchlights in harbors, general electrification of harbor defense activities, and implementation of a modern system for aiming major caliber guns and mortars (Lewis 1970:89,93).

The overall result of the Endicott and Taft programs was a "system of harbor defense unexcelled by any other nation" (Lewis 1970:100). By World War I, however, developments in naval guns and gunnery enabled battleships to engage an enemy at significantly greater distances with improved accuracy. In addition, new designs for battleship gun turrets offered higher firing angles, which meant that "shells could...be directed not only against the armored sides of ships...but also onto relatively unprotected horizontal surfaces such as decks" -- and with equal devastation onto the uncovered platforms of Endicott batteries (Lewis 1970:101). Thus, the Endicott defenses approached obsolescence barely after their construction program came to an end. Although guns remained mounted in many works until World War II (when they and their carriages were removed and scrapped), the thrust of defense programs after World War I involved weapons and technology in which the Endicott works would not, and could not, play a part.

D. <u>The Endicott Program in New York Harbor and at Fort Wadsworth</u>

By 1890, when the Endicott program was formally begun, New York Harbor contained a variety of defensive installations, all of which by that time were old fashioned and in many cases totally obsolete, but which nonetheless occupied most of the more strategic locations around the harbor. Of these, Fort Totten (on Long Island Sound), Fort Hamilton and Fort Wadsworth (at the Narrows), along with Fort Slocum on Davids Island (principally a recruitment and training post) were selected for inclusion in the Endicott program. New installations were also developed at Sandy Hook (Fort Hancock, also site of the Army's ordnance proving grounds until 1919) and, by the 1920s, Fort Tilden in the Rockaways (Gilmore 1983). The structural legacy of the Endicott program remains in evidence at all these sites except Fort Hamilton.

Implementation of the Endicott program at Fort Wadsworth involved not only new construction but a significant increase in the size of the military reservation. Between 1892 and 1901, the post was expanded from 90 to 226 acres (Black 1982:106), in order to accommodate the variety of new works proposed. Between 1895 and 1904, twelve batteries were constructed at Fort Wadsworth. Of these, six involved transformation of existing works. North Cliff battery became Battery Catlin; South Cliff battery was divided into three separate sections named Batteries Bacon, Turnbull and Barbour; a portion of Battery Hudson became Battery Mills, while the remainder of this work was substantially reconstituted under its existing name (Black 1982:110-111). Most of these new works were designed for rapid-fire guns of small caliber (3" to 6"). The exceptions were Battery Mills, where two 6-inch breech-loading rifles were mounted, and two emplacements of the rebuilt Battery Hudson, which were furnished with 12-inch breech-loading rifles. With the exception of the latter, Fort Wadsworth's largest-caliber guns were installed in six completely new batteries, five of which were constructed on newly acquired land south and west of the former boundaries of the installation. The first of these new works, Battery Duane, was begun in 1895, immediately south of Fort Tompkins, for five 8-inch guns. There followed Upton (1896, two 10-inch guns), Barry (1897, two 10-inch guns), Richmond (1898, two 12-inch guns), Ayers (1900, two 12-inch guns), and Dix (1902, two 12-inch guns). Guns were mounted in all but two of the batteries by 1904; the latter, Turnbull and Catlin, received their armament in 1910 and 1913, respectively (Black 1982:111).

Apart from proof firing when guns were initially mounted, it appears that the guns at Fort Wadsworth were rarely, if ever, fired thereafter. Indeed, the 12-inch rifles, such as those of Batteries Richmond, Ayers, and Dix, were not fired at all between 1909 and 1932, as a result of complaints from neighborhoods around the edges of the installation (Black 1982:115). Regular target practice and training of gun crews from Fort Wadsworth, as well as other New York Harbor coastal defense posts, took place at Fort Hancock, which at the end of Sandy Hook lay relatively further away from population concentrations (RG 77, Entry 802, Box 47, Folder 8, Sheet 250).

The active lives of Fort Wadsworth's twelve Endicott batteries varied considerably. The first to be constructed, Battery Duane, was considered obsolete by 1911 and formally removed from service in 1915, followed by Batteries Barry and Bacon in 1918, Barbour in 1919, and Upton in 1925. The remaining emplacements continued to carry armament until World War II, although they were not actively in service. In 1932, Battery Richmond's 12-inch guns were assigned to "Category C-2," which essentially meant that they were mothballed in place. In 1942 the guns were dismounted and placed in storage, and the carriages removed for scrap (RG 392, Records of the U.S. Coast Artillery Districts and Defenses 1901-1942, Battery Emplacement Book, Memoranda dated 12 December 1942 and 22 September 1944 by August F. Corsini, 1st Lieutenant, Ordnance Department). The guns themselves followed in 1944, bringing Battery Richmond's role in U.S. seacoast defenses to an end.

III. THE ENDICOTT PROGRAM AND ITS REALIZATION AT BATTERY RICHMOND

This section discusses general characteristics of design, construction and operation of Endicott batteries, and how these characteristics were reflected in Battery Richmond.

Works constructed under the Endicott program (1890-ca. 1905) bore little resemblance to the great masonry fortifications they superceded. Increased range, power, and accuracy of the new weapons eliminated the need for massive concentration of armament characteristic of major Third System works, and development of the disappearing carriage meant that emplacements no longer needed to be heavily enclosed to protect their gun crews. Thus the new generation of large-caliber batteries usually consisted of only two to four emplacements, arranged side-by-side rather than in casemate tiers. Where the available land permitted, batteries could be relatively dispersed throughout a reservation (as at Fort Wadsworth, but not at Fort Totten, where site constraints produced a line of batteries set very close together). Unlike the earlier fortifications, too, Endicott era works eschewed the visibility of high stone walls and prominent locations at the water's edge or highest ground, instead being explicitly designed to blend insofar as possible into the surrounding landscape. This was achieved not only by the low profiles of these structures, but by the extensive frontal earthworks which provided not only protection but, particularly when left a bit rough and planted with bushes, rendered the works almost invisible from the front (Lewis 1970:79).

Speed was also a distinguishing characteristic of construction under the Endicott program. Whereas, for example, a Third System fortification like Fort Richmond required 13 years to complete, the installation's twelve Endicott batteries were completed in about nine years, with few batteries, including Battery Richmond, requiring even two years to finish. The expeditious nature of the Endicott works appears to have been a function of the urgency of the program, the structural and functional simplicity of the batteries, and the use of concrete rather than the admittedly more awe-inspiring, but labor- (and skill-) intensive stonemasonry typical of many Third System works.

Another departure from earlier coastal defense programs was that the Endicott program involved highly complex and expensive armament placed in simple, relatively inexpensive works, whereas the reverse was the case in preceding systems. According to Lewis (1970:78) in 1900 a pair of emplacements for 12" guns on disappearing carriages, such as Battery Richmond, cost approximately $100,000, while the cost of the two guns and their carriages (without ammunition) came to approximately $180,000, of which approximately half went for the carriage alone. In contrast, prior to 1890 a carriage had cost about a third that of a gun, and under $15 million was expended to construct 17 forts under the Third system, supply them with guns, and provide 100 rounds of ammunition for each.

Responsibility for the physical realization of the Endicott program lay with the U.S. Army's Corps of Engineers, which had historically been charged with "selection of sites and formation of plans and estimates for military defenses; [and] construction and repair of fortifications and their accessories" (Winslow 1907:236). Under the general supervision of the Chief of Engineers was a Board of Engineers for Fortification, composed of three senior Engineer officers, whose function was "to formulate a general plan for the defenses of any harbor, to decide upon the number of guns of different caliber, the location of these guns, and the general character of the batteries for them" (Winslow 1907:237). During the Endicott period an Artillery officer was added to the Board, since "the fighting [sic] of the guns is done by the artillery, and not by the engineers, and it is therefore right and proper that before deciding on any essential details,the engineer department should consult the wishes of the Artillery" (Winslow 1907:237).

The design process for Endicott works actually began in the Army's Ordnance Department, which designed the guns and carriages. Drawings of guns and mounts, along with "platform sheets" containing various specific requirements, such as the difference in elevation between the loading platform and the crest of the parapet, the shape of the front of the loading platform, and the shape and size of steps behind the gun carriages, were then forwarded to the Board of Engineers, which developed type plans, or "mimeographs," for the various gun/carriage combinations. (Winslow 1907:238,259). Once a particular project was funded ("usually in much smaller amounts than the Engineer Department estimates"), the Board transmitted appropriate type plans to the officer in charge of the Engineer District in which the project was to occur. The District Engineer was ultimately responsible for the preparation of detailed plans, specifications and estimates for each work (Winslow 1907:238).

The type plans were not intended to be followed literally. The function of an emplacement was to provide a firm platform for the gun, protect personnel and armament from both enemy fire and the "action of the elements," and contain space enough for safe storage of ammunition and supplies. Beyond ensuring that each emplacement was "in all details so arranged as to make the service of the gun as easy and efficient as possible," the district officer had considerable latitude in the actual design of the work. "In working up the details of any particular emplacement, the District officer is supposed to use the proper mimeographs as a guide, but the mistake must not be made of slavishly following the mimeographs in all details. These type plans are made to suit general conditions and all the general conditions are almost never fulfilled. A careful study must be made of the field of fire desired and of the angular range over which this fire is to extend. The side of the gun on which the magazine is to be placed requires careful study, and the contour of the ground in the neighborhood of a battery should be noted. [In] all these details...modifications of the typical plan are desirable and permissible" (Winslow 1907:238).

Batteries were constructed under the authority of the District Engineer, under direct supervision of a resident construction engineer. Although some Endicott works were let to contractors, the Engineers' preference was for "hire-labor," locally obtained. This preference was, at least in part, due to concern about the "undue publicity necessarily given to the plans to enable intending bidders to submit proposals intelligently." More to the point, however, it was the opinion of the Chief of Engineers that "the nature of the work is such that perfect freedom to introduce changes during construction is extremely desirable, a freedom that is seriously hampered by the existence of a contract" (Annual Report of the Secretary of War, 1897, Report of the Chief of Engineers, Part 1:9).

The principal material of Endicott batteries was concrete. In the early years of the construction program, Portland cement was not readily available in quantity in the U.S. or at a price which could be justified before Congressional appropriations committees. Thus, for "reasons of economy," a natural cement, called Rosendale, was employed in the earliest works. By about 1897, however, Portland cement became both available and affordable, and thereafter all Endicott batteries, including Battery Richmond, were constructed with this material (Winslow 1907:242; Annual Report of the Secretary of War, 1899, Report of the Chief of Engineers, Appendix No. 4:774).

A common formula for Endicott-era concrete was 1 unit of cement, 3 units of sand and 5 units of "broken stone" (Annual Report of the Secretary of War, 1895, Report of the Chief of Engineers, Appendix 1:504). Sand was invariably obtained locally, most commonly from the shores of the military reservation itself (Winslow 1907:253). In early works large irregularly-shaped rocks were also incorporated into the concrete of parapets, gun block foundations and beneath magazines. In particular, their placement within parapets was intended to increase the "impenetrability of the mass" by deflecting any projectiles which might penetrate the concrete. Subsequently, cost considerations, plus improved quality of concrete and greater understanding of the protective capabilities of earth (and especially sand) appear to have ended the use of large rocks in parapet construction (Winslow 1907:250-51).

Concrete was manufactured on site. A sense of the magnitude of the construction "plants" associated with Endicott projects is conveyed in the following description of the plant used during the reconstruction of Battery Hudson at Fort Wadsworth:

"Cement and broken stone are received at the south wharf, where they are unloaded by hoisting engine and a trolley into flat car or dump cars...and are hauled by a 10-ton locomotive to the cement shed and stone bins at the foot of the bluff. The stone bin is of the usual type, receiving materials from a trestle above and discharging through the floor into cars in the tunnel beneath. Sand is excavated from the beach and hauled by carts to a platform at the end of the bin, where it is fed into a hopper and with the cement is also discharged through the floor of the car, which is then hauled up an incline to the mixer... The concrete when mixed is dumped into wooden boxes on flat cars and is hauled up a light inclined trestle...where it is supplied to the derricks operated by steam hoisting engines and moved from time to time as work progresses....The derricks were used in excavating for parapets after construction of platforms, and later for placing the concrete in parapets and magazines" (Blaok 1982:114).

Construction of Battery Richmond itself was more briefly desoribed, but sufficiently to suggest the process was essentially the same for each battery. "The site of the battery being at some distance from the wharf the materials were hauled from the wharf to the bins by carts...concrete was mixed in a four foot cubical mixer, some hand mixing platforms occasionally supplementing the days work, and was placed by derricks to which it was supplied in boxes on flat cars from the mixer." When completed, the two emplacements and parapet of Battery Richmond contained over 16,000 cubic yards of concrete (Annual Report of the Secretary of War, 1899, Report of the Chief of Engineers, Appendix 4:774).

The construction plants, although expensive to set up, were maintained and reused, thereby reducing construction costs at subsequent works at a given installation (Annual Report of the Secretary of War, 1897, Report of the Chief of Engineers, Part 1: 11).

The parapets contained, in addition to thousands of cubic yards of concrete, massive fronts and flanks of earth as well. Battery Richmond required 9,800 cubic yards of earth, obtained from excavations for the foundation and adjacent access road (Ibid.:773). The use of earth as well as concrete in Endicott parapets was in large measure a function of cost: parapets wholly of concrete were simply "too expensive," particularly in light of the ready availability of earth and sand on many installations in which Endicott works were constructed.

As illustrated by Battery Richmond, the magazines were located in traverses between gun platforms or on the outer flanks of the work, beneath 10-15 feet of concrete, the top of which was at the same elevation as that of the parapet. In large emplacements, the area beneath the loading platform was commonly divided into rooms. The area available for these spaces was determined by the size of the foundation of the gun block and the area of the loading platform. Once these had been determined, the resulting space beneath the platform was subdivided into smaller spaces, the curious proportions of which reflect their somewhat awkward arrangement around the gun block. In early designs, "it was thought to be necessary to make the ceilings of all the rooms and galleries in the form of full center arches" (Winslow 1907:260). However, the need to provide sufficient protection over the center of such arches meant that the floors of large rooms, in particular, had to be set very low, and the total amount of concrete in the covering (and thus construction costs) increased accordingly. By mid-1896, the Board of Engineers had decided that ceilings were to be flat, supported on I-beams which were usually embedded several inches from the exposed surface.

Subsequently, in 1903, reinforcing bars were officially adopted by the Board for ceiling construction (Winslow 1907:260-262).

Although concrete was the specified material for batteries, Engineer officers in charge of construction appear to have made selective use of other materials at their own discretion. At Fort Wadsworth, the Endicott batteries built on earlier works commonly reincorporated significant amounts of finely dressed granite into the new emplacements. Brick was also used for features such as corners and door jambs: the latter is illustrated at Battery Richmond most obviously in the exterior entrances to the shot galleries and adjacent rooms. The use of such materials was not universally condoned within the Engineer Department, however, since such details, however aesthetically pleasing, were essentially "unnecessary" and (unless obtained as salvage) "cost money" (Winslow 1907:262).

The 12-inch breech-loading rifles mounted at Battery Richmond were of built-up forged-steel construction. The guns were model 1888 M11; one was manufactured at the Bethlehem Iron Co., the other at Watervliet Arsenal. The carriage for emplacement No. 1, Model LFD 1896 Serial 26, was manufactured by Bethlehem Iron Co., while that for No. 2 (LFDC Model 1896, Ser. 10) was manufactured by the Morgan Engineering Co. of Alliance, Ohio (RG 392, Records of the U.S. Coast Artillery Districts and Defenses, 1901-1942, Battery Emplacement Book for Battery Richmond, Section 4(b)).

The Model 1888 rifle had a length of 439.9 inches, weighed 52 tons, and had a maximum range of 15,134 yards (Hines and Ward 1910:110). Each gun was mounted on a Buffington-Crozier "disappearing carriage," so named for officers of the Army's Ordnance Department who were responsible for the initial development of this carriage type in the United States (Bruff 1904:430).

Although disappearing carriages varied according to the size of gun and over time as a result of continuing refinements, their principal features remained relatively consistent. The bottom element was a cast iron base ring, cast in halves and bolted and keyed together, and held in position in the emplacement with bolts. On the upper surface of the base ring was the lower path of the traverse roller system, which contained conical forged steel rollers. On the rollers moved the racer, a circular steel "plate" of box section, cast in halves and bolted and keyed together. The chassis, of cast iron, was mounted on the racer, and provided the supports for the gun and recoil mechanism. The top carriage, of steel, consisted of two side frames containing beds for the gun lever axles and the two hydraulic recoil cylinders; it rested on two sets of rollers which ran on steel axles set into moveable steel cages which ran along the upper surface of the chassis. The gun itself was carried on the upper ends of a pair of cast steel gun levers, which were connected near their upper ends by a steel yoke, and at a point just below the middle by the forged steel gun lever axle, the projecting ends of which acted as trunnions supported by and rotating in the axle beds in the top carriage. At the lower ends of the gun levers was a crosshead, from which a cage, consisting of four rods and a bottom plate, was suspended. Within this cage was the counterweight, consisting of 140,000 pounds or more of lead in layers of varying thickness, each layer containing two or more pieces. Small pieces on the top were fitted with rings so that they could be handled to obtain the desired weight (Hines and Ward 1910:199ff; Bruff 1904:430-31).

All movements of the gun could be accomplished by men operating hand cranks to traverse, retract, elevate and depress the pieoe as desired. However, the carriages were also supplied with a system of two electric motors, bolted onto the chassis, one for traversing, the other for elevating, depressing and retracting. At Battery Richmond, electric power was originally provided from a powerhouse located at the rear of the battery. Subsequently, however, self-contained power generating facilities, consisting of 25 kw gasoline-electric generator sets, were installed in the westernmost room below the loading platform (RG 77, Dr. 46, Sheet 96-14). The conduits and wiring for the motors entered the gun platform at the counterweight well, through a duct in the concrete in the rear wall of the well below the base ring (Hines and Ward 1910:226).

When a gun was in firing position ("in battery"), the barrel cleared the parapet. However, upon firing, the force of the recoil (duration of which was one second) drove the barrel back, the muzzle moving in a swift, "sinuous curve," and as the lever arms turned about the axle the massive counterweight was raised from the well sunk into the gun platform. With the recoil buffered by the hydraulic cylinders, the gun descended below parapet level until the breech was approximately 3 feet above the floor of the loading platform, and thus in position ("from battery") for reloading. While being loaded, the gun was held in place below the parapet by a ratchet on the counterweight. When the ratchet was released or "tripped," the counterweight dropped back into the well and in so doing raised the lever arms to bring the gun barrel back above the parapet to be fired once more (Harmon 1895:52-53; Hogg 1981:177; Bruff 1904:430-431). As one observer of test firing at Fort Hancock noted in 1895, "the action of the whole appears as gentle and graceful as that of a senorita's fan on a summer day" despite the "tremendous energies at work" (Harmon 1895:54).

A gun was loaded by the ammunition detachment of the gun section from small three-wheeled steerable hand trucks with adjustable trays designed to carry a complete charge (a projectile and the powder charges required to propel it to its intended destination). (Hines and Ward 1910:510). The projectiles (each of which for Model 1888 weighed 1046 lb.), were hoisted from below to the delivery table, whereupon they were either moved to the adjacent reserve table or placed upon the truck. The nitro-cellulose powder charge, put up in two or three separate sections, each contained in a silk bag, were brought from the powder magazine by hand and placed on the truck below the projectile. The assemblage was then wheeled across the loading platform to the gun (Hines and Ward 1910:110, 510).

The aiming systems developed during the Endicott and Taft periods were a "significant advance" over those previously employed in coastal defense. In the latter, aiming had been done from each individual gun with "elementary sighting instruments," with the result that "accuracy of fire against moving targets had remained largely a matter of art, experience and educated guessing." According to Lewis (1970:93), "the new system...was based on a combination of optical instrumentation of great precision, the rapid processing of mathematical data, and the electrical transmission of target sighting and gun-pointing information. Of the several methods of fire control...the most elaborate and precise made use, for a given battery, of two or more widely spaced sighting structures technically known as base-end stations. From these small buildings simultaneous optical bearings were continuously taken of a moving target, and the angles of sight were communicated repeatedly to a central battery computing room. Here the successive sightings were plotted and future target positions were predicted. Allowances were made and corrections worked in for meteorological factors and for such other variables as target progress during the projectile time of flight and during the time taken to calculate and transmit the various data. The computed products were then translated into aiming directions which were forwarded electrically to each gun emplacement or mortar pit."

In the early years of the Endicott program, the principal means of communication within a battery was a system of speaking tubes linking various rooms and magazines with the crownests and guns, and by which ranges and other data necessary for aiming were transmitted to the plotting room and from there to the guns. These tubes, however, proved most unsatisfactory, because when the battery was in operation, the rumbling of ammunition trucks, rattling of the trolleys and other noises were quickly transmitted through the concrete to the tubes, resulting in "a roaring which practically prohibit[ed] conversation" (Haan 1902:289; Winslow 1908:50). Communications were subsequently improved by installation of telephones and teleautographs. The latter, located in a niche in the wall of the loading platform, was an electro-mechanical devices by which the movement of an attached pencil at one end of the circuit was automatically reproduced at the other end (Hines and Ward 1910:56). Use of teleautographs to transmit information to the guns appears to have lasted until World War I; at Battery Richmond teleautographs were removed in 1914 and within two years replaced with an improved telephone system (RG 392, Records of the U.S. Coast Artillery Districts and Defenses, 1901-1942, Battery Emplacement Book, Battery Richmond, Section 4).

Battery commanders commonly were stationed in a crownest, usually that located in the center traverse, from which they could observe activities in both emplacements. These so-called "BC" stations were quipped with a variety of communications, sighting equipment and charts, for example telephones, azimuth instruments and tables for battery manning, orientation and salvo firing (see for example RG 392, Records of the U. S. Coast Artillery Districts and Defenses 1901-1942, Battery Emplacement Books, Battery Richmond, Part 2). To protect such stations from weather, they could be roofed over and partly enclosed. Alternatively, separate BC stations were built, concrete structures set on or behind a battery, which commonly contained a plotting room below (Hogg 1981:177). At Battery Richmond, the plotting room was contained beneath the loading platform in the space originally designated as "guard room" adjacent to the shot gallery (RG 392, Records of the U.S. Coastal Artillery Districts and Defenses, 1901-1942. Battery Emplacement Book, Battery Richmond, Sect. 2B. and Plan). The function of personnel in the plotting room was to locate and correct the range and azimuth of targets and to transmit position information to the guns. Typical furnishings of a plotting room included a plotting board, range board, deflection board, wind component indicator, aeroscope, time-interval bell, time-interval clock (stopwatch), and telephones and teleautograph (Hines and Ward 1910:304).

A relatively large number of men were required to properly man a battery. According to a regulation of 1914, a battery such as Battery Richmond with two 12-inch rifles required three officers plus 113 enlisted men comprising the range section (which included observers and plotters who identified the target and provided information for proper positioning of the guns) and the gun section (responsible for loading and firing and other physical manipulations of the piece) (Black 1982:127). The space available on the platform, however, often proved limiting when the battery was in operation. In the case of Endicott mortar batteries, the four-pit design originally developed had to be discarded for a two-pit design due to the crowded conditions which obtained in the emplacement when all four mortars were firing (Lewis 1970:84). In the case of rifle batteries, such as Battery Richmond, it was the gradual improvement in rates of firing which led to complaints from the Artillery Corps about the depth of loading platforms on 10- and 12-inch emplacements. At the time of their design and construction, "guns were fired not more than once in every two or three minutes," and thus "a greater depth [in the platform] was not necessary to facilitate the rapid movement of the gunners". Although the loading platforms of the large guns were widened at batteries at Fort Hancock, where gun crews from all New York Harbor installations practiced, similar work was not carried out at Fort Wadsworth, due in large measure to lack of funding (RG 77, Entry 802, Box 47, Folder 8, Sheet 250; and Ibid., Box 49, Folder 40, Sheet 3).

Thus, Battery Richmond remained essentially as originally designed and constructed, until its guns were removed during World War II for scrap. By then, the concepts of national defense from which the Endicott program had emerged in the late nineteenth century had been discarded. For Fort Wadsworth, the Endicott program marked the last in a series of harbor defense construction programs that had begun over a century before. With the exception of several antiaircraft emplacements installed during World War II, no other defensive works were erected at Fort Wadsworth.

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RG 77, Fortifications File, Drawer 43, Sheet 96: Detail Plan of Emplacements for Two Twelve-Inch Guns on Disappearing Carriages, Model 1896...March 18, 1898.

RG 77, Fortifications File, Drawer 43, Sheet 96-2: Fort Wadsworth, NY. Plan of Emplacements for High Power Guns showing Proposed Ducts for Electric Wires. October 1902.

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RG 77, Fortifications File, Drawer 43, Sheet 96-4: Plan Showing Drainage and Electric Systems, Battery Richmond, Fort Wadsworth, N.Y. March, 1908.

RG 77, Fortifications File, Drawer 43, Sheet 96-8: Fort Wadsworth, N.Y. Plan for Installing Type C Powder Hoists in Battery Richmond. January 1910.

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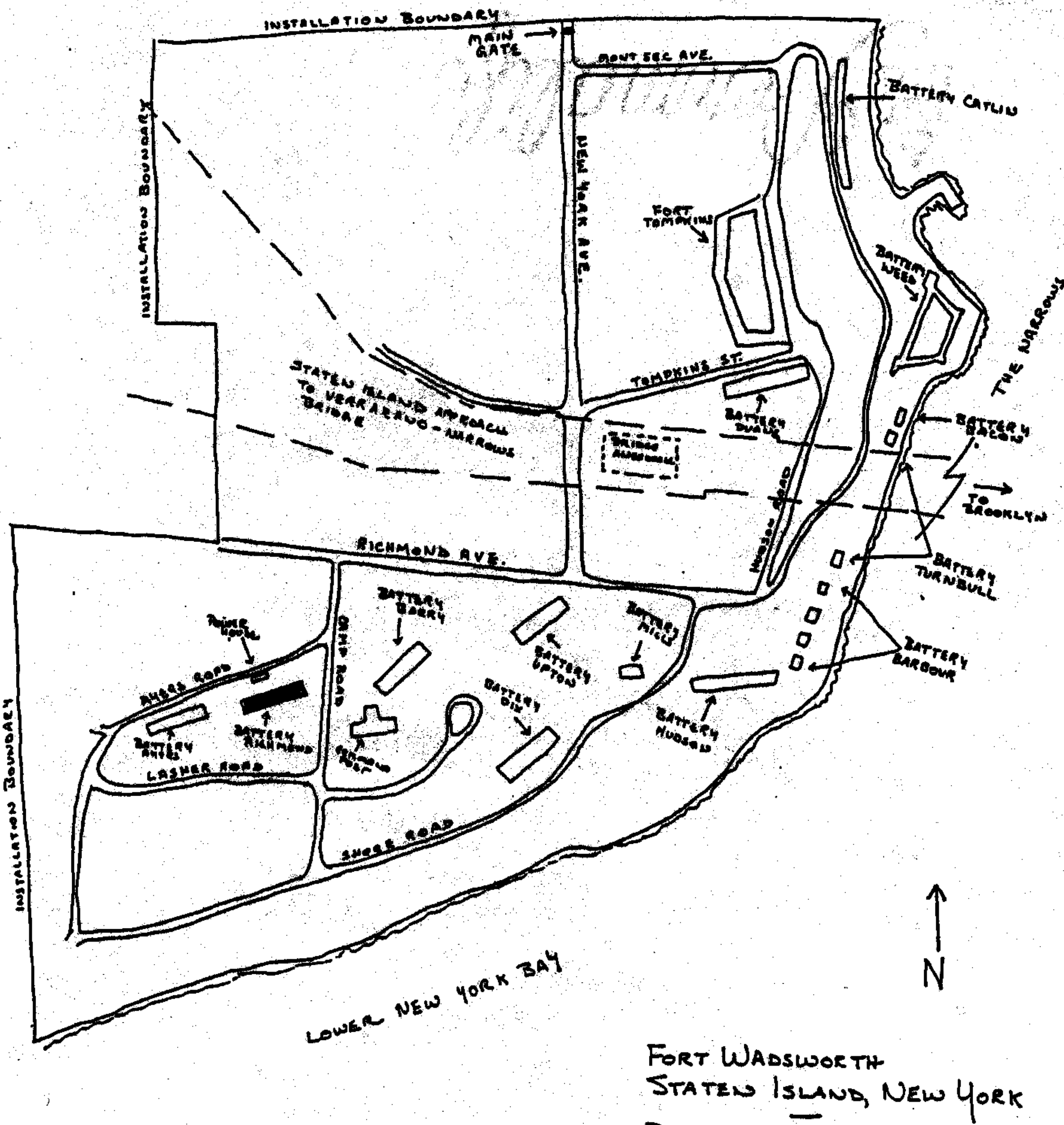
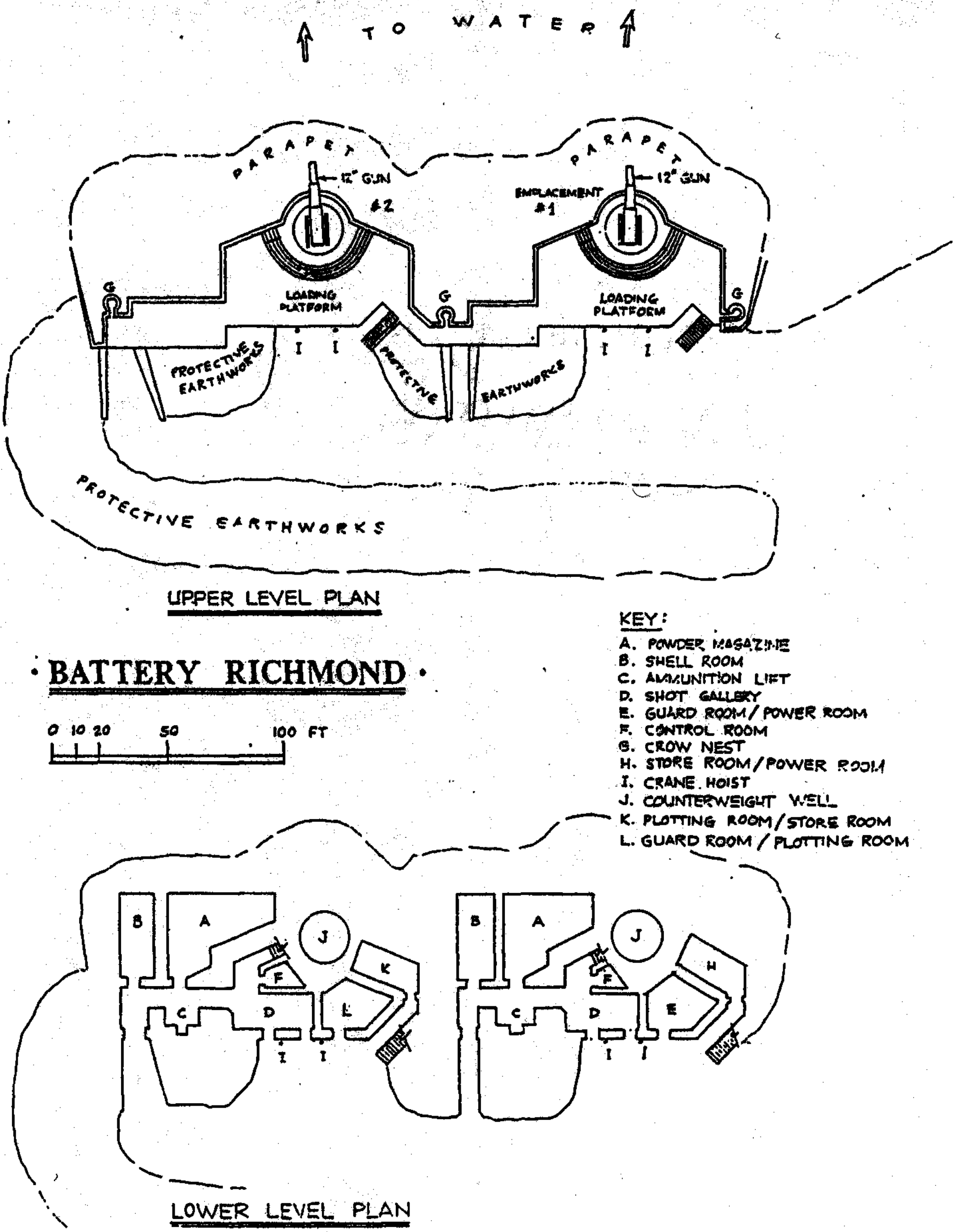


FORT WADSWORTH
STATEN ISLAND, NEW YORK

PLAN OF INSTALLATION SHOWING
SEACOAST FORTIFICATIONS

NO SCALE


TO WATER
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12" GUN
12" GUN
#2
EMPLACEMENT #1
G
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KEY:
A. POWDER MAGAZINE
B. SHELL ROOM
C. AMMUNITION LIFT
D. SHOT GALLERY
E. GUARD ROOM/POWER ROOM
F. CONTROL ROOM
G. CROW NEST
H. STORE ROOM/POWER ROOM
I. CRANE HOIST
J. COUNTERWEIGHT WELL
K. PLOTTING ROOM/STORE ROOM
L. GUARD ROOM/PLOTTING ROOM
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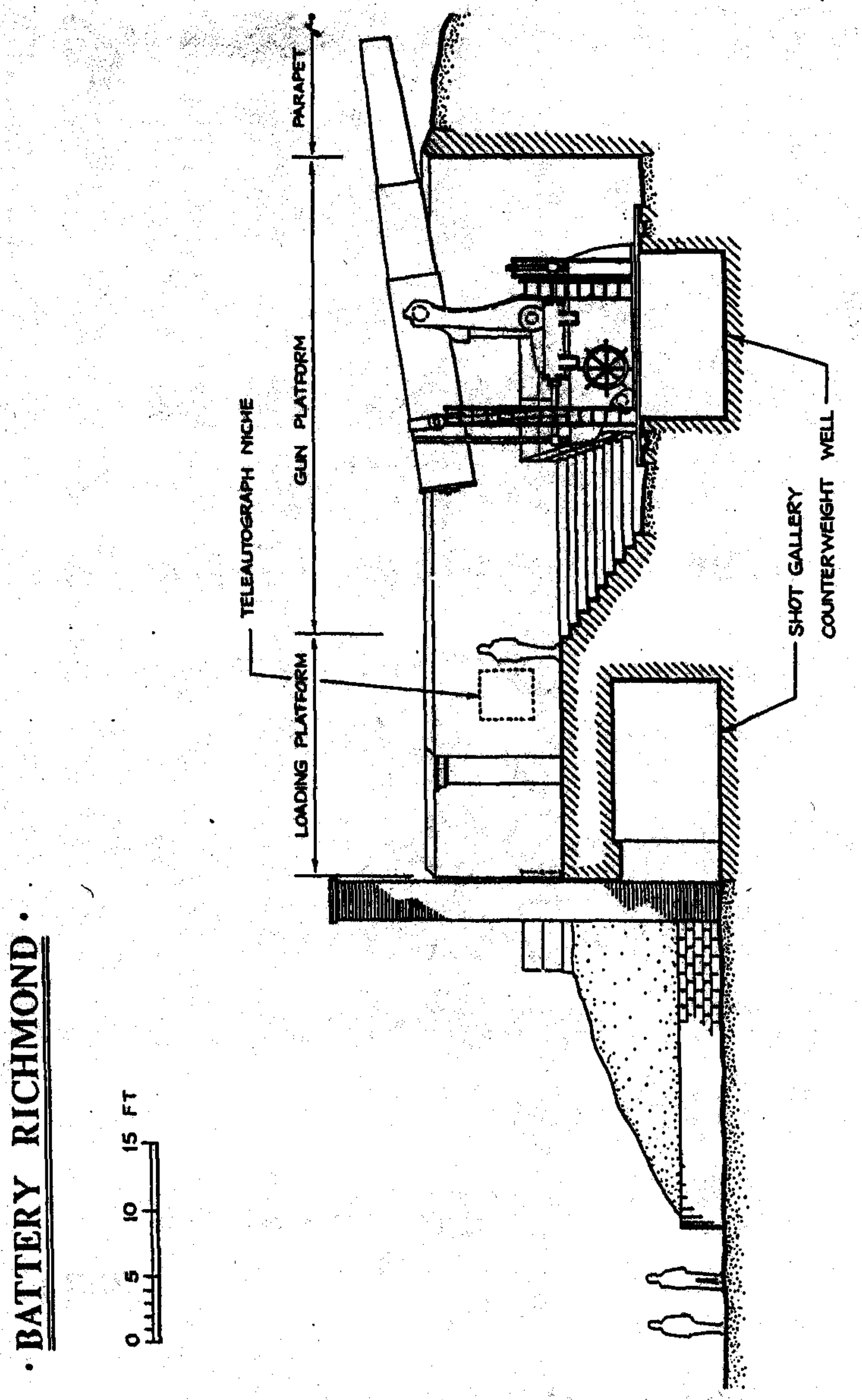
LOWER LEVEL PLAN


BATTERY RICHMOND
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PARAPET
GUN PLATFORM
LOADING PLATFORM
TELEAUTOGRAPH NICHE
SHOT GALLERY
COUNTERWEIGHT WELL